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# Red Rock Reservoir, Marion County, Iowa

National Eutrophication Survey, Corvallis, Oreg

Prepared for

Corvallis Environmental Research Lab, Oreg

Sep 76

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**16. ABSTRACT**

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

**KEY WORDS AND DOCUMENT ANALYSIS**

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|---|---|---|
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# U.S. ENVIRONMENTAL PROTECTION AGENCY
# NATIONAL EUTROPHICATION SURVEY

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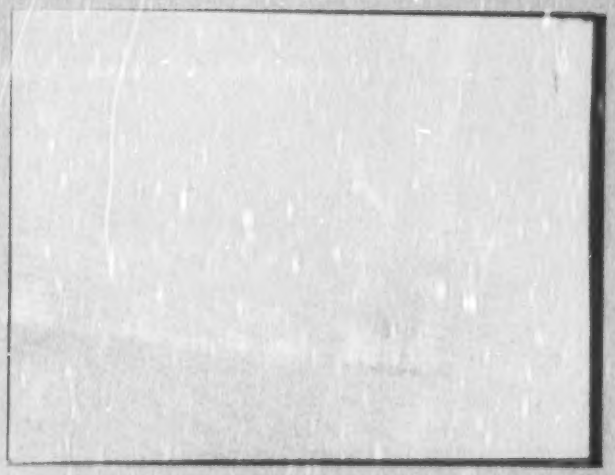

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# REPORT
# ON
# RED ROCK RESERVOIR
# MARION COUNTY
# IOWA

EPA REGION VII

WORKING PAPER No. 503

WITH THE COOPERATION OF THE

IOWA DEPARTMENT OF ENVIRONMENTAL QUALITY

AND THE

IOWA NATIONAL GUARD

SEPTEMBER, 1976

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# FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

## OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

## ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

## LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Iowa Department of Environmental Quality for professional involvement, to the Iowa National Guard for conducting the tributary sampling phase of the Survey, and to those wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

The staff of the Water Quality Division of the Department of Environmental Quality provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

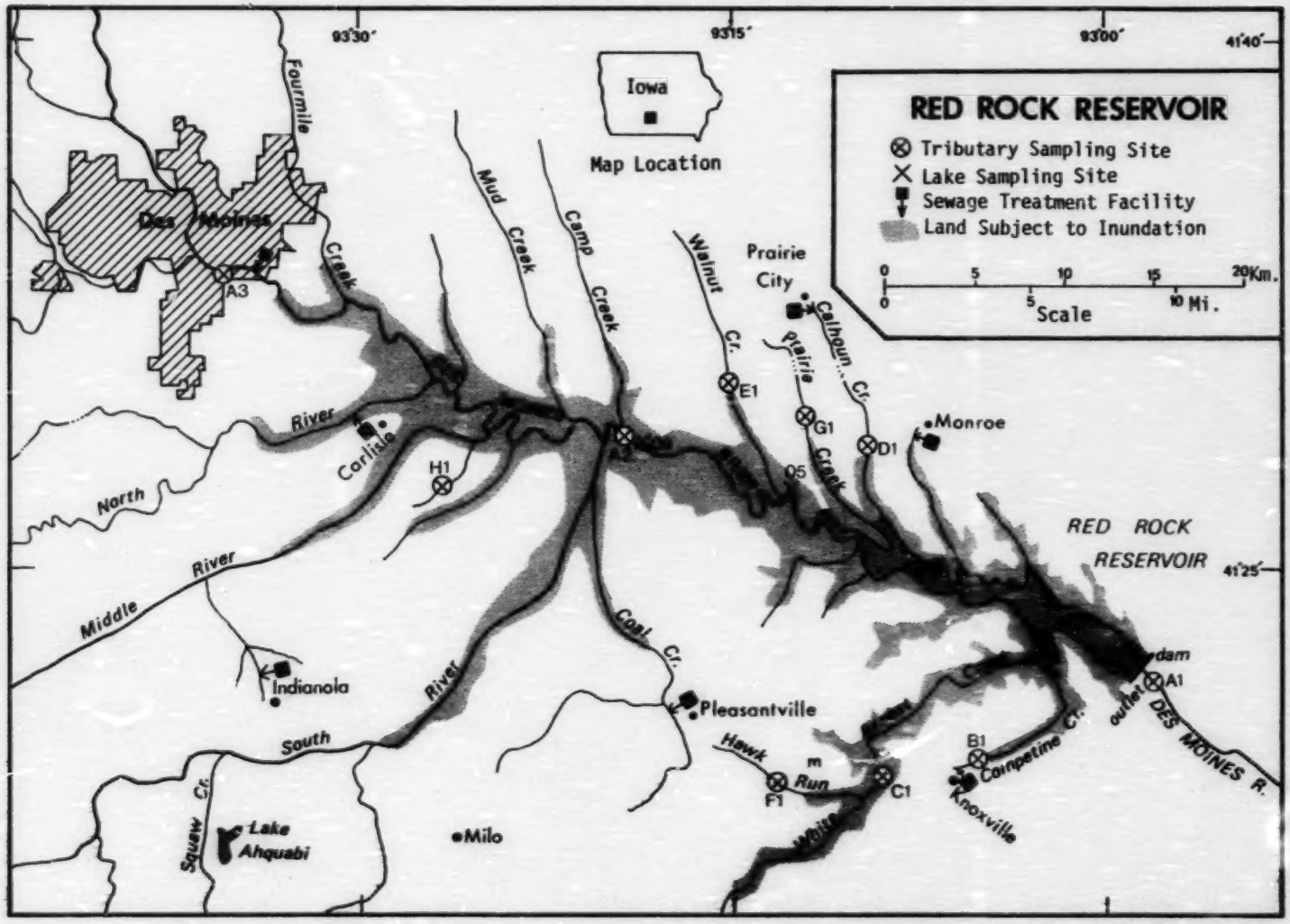
Major General Joseph G. May, the Adjutant General of Iowa, and Project Officer Colonel Cleadeth P. Woods, who directed the volunteer efforts of the Iowa National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

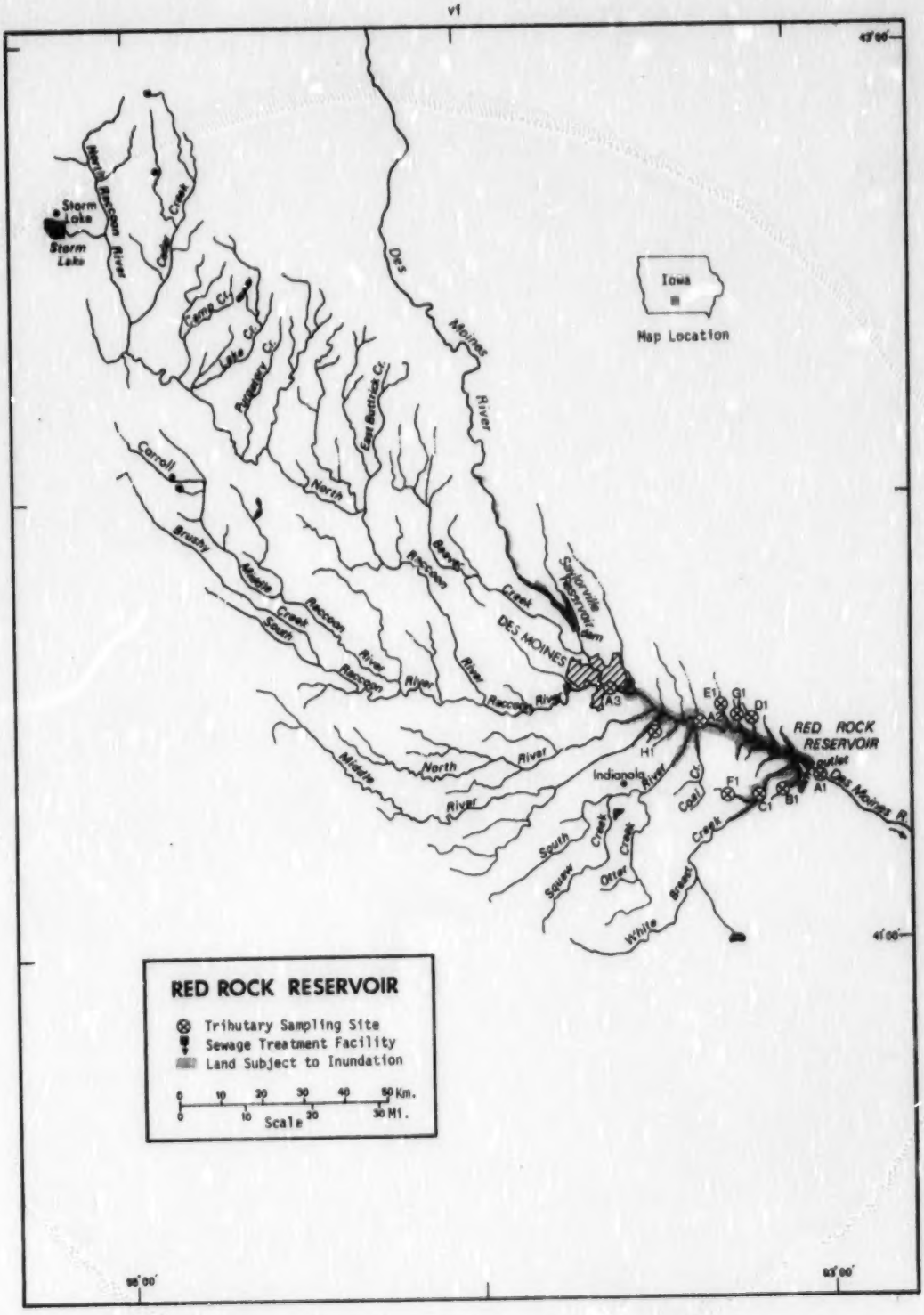
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF IOWA

| LAKE NAME | COUNTY |
|---|---|
| Ahquabi | Warren |
| Big Creek Reservoir | Polk |
| Black Hawk | Sac |
| Clear | Cerro Gordo |
| Darling | Washington |
| Lost Island | Clay, Palo Alto |
| MacBride | Johnson |
| Prairie Rose | Shelby |
| Rathbun Reservoir | Appanoose, Wayne |
| Red Rock Reservoir | Marion |
| Rock Creek | Jasper |
| Silver | Worth |
| Spirit | Dickinson |
| Viking | Montgomery |
| West Okoboji | Dickinson |


RED ROCK RESERVOIR
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Land Subject to Inundation
0 5 10 15 20Km.
0 5 10 Mi.
Scale
Iowa
Map Location
93°30'
93°15'
93°00'
41°40'
41°25'
Fourmile Creek
Mud Creek
Camp Creek
Walnut Cr.
Prairie City
Calhoun Cr.
Prairie Creek
Des Moines
A3
E1
G1
D1
Monroe
River
Carlisle
H1
North
River
Middle
River
Indianola
South
River
Squaw Cr.
Lake Ahquabi
Milo
Coal Cr.
Pleasantville
Hawk Run
F1
C1
B1
Competine Cr.
Knoxville
RED ROCK RESERVOIR
dam
A1
outlet
DES MOINES R.


Storm Lake
Storm Lake
North Raccoon River
Cedar Creek
Camp Ck.
Lake Ck.
Patterson Cr.
East Buttrick Cr.
Des Moines River
Iowa
Map Location
Carroll
North
Brushy
Middle
Creek
South
Raccoon
River
Beaver
Creek
Saylorville Reservoir dam
DES MOINES
A3
E1
G1
D1
A2
H1
RED ROCK RESERVOIR
outlet
Des Moines R.
Indianola
North
River
Middle
River
Cedar
Creek
F1
C1
B1
A1
South
Creek
Otter
Creek
Squaw
Creek
White
Breed
43°00'
41°00'
93°00'
RED ROCK RESERVOIR
Tributary Sampling Site
Sewage Treatment Facility
Land Subject to Inundation
0 10 20 30 40 50 Km.
0 10 20 30 MI.
Scale

RED ROCK RESERVOIR

STORET NO. 1910

# I. CONCLUSIONS

## A. Trophic Condition:

Survey data indicate that Red Rock Reservoir is eutrophic. It ranked thirteenth in overall trophic quality when the 15 Iowa lakes and reservoirs sampled in 1974 were compared using a combination of six parameters*. Twelve of the water bodies had less median total phosphorus, all of the others had less median dissolved phosphorus, 12 had less median inorganic nitrogen, five had less mean chlorophyll a, and nine had greater mean Secchi disc transparency. Marked depression of dissolved oxygen with depth occurred at stations 1, 3, and 5 in July.

## B. Rate-Limiting Nutrient:

The algal assay results indicate the reservoir was phosphorus limited at the time the sample was collected (04/18/74). The reservoir data indicate phosphorus limitation in September also.

## C. Nutrient Controllability:

1. Point sources--The phosphorus contribution of known point sources accounted for about 17% of the total load reaching Red Rock Reservoir during the sampling year. Almost all of the point-source load came from the Des Moines wastewater treatment plant (16.4% of the total).

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* See Appendix A.

The present phosphorus loading of 68.95 $g/m^2/yr$ is more than 35 times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 14). However, Vollenweider's model probably is not applicable to water bodies with short hydraulic retention times, and the mean hydraulic retention time of Red Rock Reservoir is only 10 days. Nonetheless, the existing trophic condition of the reservoir is evidence of excessive nutrient loads.

On the basis of Survey data, the trophic condition of Red Rock Reservoir will very likely continue to deteriorate if the present loading is maintained. Therefore, all phosphorus inputs should be minimized to the greatest practicable extent to reduce the rate of eutrophication.

2. Non-point sources--Non-point sources accounted for about 83% of the total phosphorus load reaching the reservoir during the sampling year. The Des Moines River contributed over 78% of the total.

The phosphorus export rate of the Des Moines River was 65 $kg/km^2/yr$ (see page 13). This rate is within the range of other tributaries studied in this area of the state and appears to be typical of a heavily-cultivated watershed.

Fluctuations in the water level of the reservoir may add to the non-point contributions. In July, 1974, the Survey limnologists reported flooded farmland in the vicinity of Red Rock Reservoir. During the April and September visits, however, lake sampling sites 4, 5, and 6 were dry (see map, page v).

The upper portion of Red Rock Reservoir is a wildlife refuge, and ducks and geese utilize the area during spring and fall migrations (Harrison, 1976). However, only a few waterfowl counts were made during the Survey sampling year (Bishop, 1976), and an assessment of the nutrient contributions of migrating ducks and geese cannot be made.

## II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

### A. Lake Morphometry††:

1. Surface area: 36.22 kilometers$^2$.
2. Mean depth: 3.0 meters.
3. Maximum depth: 10.7 meters.
4. Volume: 108.660 x $10^6$ $m^3$.
5. Mean hydraulic retention time: 10 days.

### B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

| Name | Drainage area ($km^2$)* | Mean flow ($m^3$/sec)* |
|---|---|---|
| Des Moines River | 30,186.4 | 114.46 |
| White Breast Creek | 984.2 | 5.51 |
| Calhoun Creek | 58.8 | 0.33 |
| Minor tributaries & immediate drainage - | 651.0 | 3.84 |
| Totals | 31,880.4 | 124.14 |

2. Outlet -

| | | |
|---|---|---|
| Des Moines River | 31,916.6** | 121.04 |

### C. Precipitation***:

1. Year of sampling: 70.7 centimeters.
2. Mean annual: 82.7 centimeters.

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† Table of metric conversions--Appendix B.
†† Mayhew, 1972.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of reservoir.
*** See Working Paper No. 175.

## III. LAKE WATER QUALITY SUMMARY

Red Rock Reservoir was sampled three times during the open-water season of 1974 by means of a pontoon-equipped Huey helicopter. Samples for physical and chemical parameters were collected from a number of depths at two stations on the reservoir in April, five stations in July, and three stations in September (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the sampled stations for phytoplankton identification and enumeration; and during the April visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the sampled stations for chlorophyll a analysis. The maximum depths sampled were 18.9 meters at station 1, 6.4 meters at station 2, 13.7 meters at station 3, 9.8 meters at station 4, 13.1 meters at station 5, and 4.6 meters at station 6.

The sampling results are presented in full in Appendix D and are summarized in the following table (the July nutrient samples were not preserved properly and were not analyzed).

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR RED ROCK LAKE
STORET CODE 1910

| PARAMETER | 1ST SAMPLING ( 4/18/74) 2 SITES RANGE | MEAN | MEDIAN | 2ND SAMPLING ( 7/ 8/74) 5 SITES RANGE | MEAN | MEDIAN | 3RD SAMPLING ( 9/24/74) 3 SITES RANGE | MEAN | MEDIAN |
|---|---|---|---|---|---|---|---|---|---|
| TEMP (C) | 10.5 - 13.6 | 11.9 | 11.3 | 20.5 - 28.4 | 24.5 | 23.8 | 16.7 - 17.9 | 16.9 | 16.8 |
| DISS OXY (MG/L) | 9.8 - 12.4 | 10.8 | 10.2 | 1.0 - 10.8 | 6.5 | 6.6 | 7.4 - 9.0 | 8.1 | 8.0 |
| CNDCTVY (MCROHO) | 517. - 617. | 565. | 558. | 434. - 792. | 619. | 594. | 531. - 598. | 562. | 535. |
| PH (STAND UNITS) | 8.2 - 8.5 | 8.3 | 8.3 | 7.6 - 8.6 | 8.1 | 8.1 | 7.5 - 7.6 | 7.6 | 7.5 |
| TOT ALK (MG/L) | 330. - 390. | 358. | 360. | ****** -********** | | | 210. - 254. | 236. | 238. |
| TOT P (MG/L) | 0.178 - 0.212 | 0.195 | 0.195 | ****** -********** | | | 0.155 - 0.670 | 0.232 | 0.176 |
| ORTHO P (MG/L) | 0.104 - 0.135 | 0.123 | 0.123 | ****** -********** | | | 0.062 - 0.265 | 0.091 | 0.070 |
| NO2+NO3 (MG/L) | 8.850 - 9.750 | 8.962 | 8.980 | ****** -********** | | | 1.360 - 1.840 | 1.630 | 1.600 |
| AMMONIA (MG/L) | 0.030 - 0.080 | 0.057 | 0.060 | ****** -********** | | | 0.040 - 0.340 | 0.082 | 0.050 |
| KJEL N (MG/L) | 0.600 - 0.800 | 0.675 | 0.700 | ****** -********** | | | 0.600 - 1.580 | 0.833 | 0.700 |
| INORG N (MG/L) | 8.100 - 9.820 | 9.020 | 9.025 | ****** -********** | | | 1.590 - 1.880 | 1.712 | 1.700 |
| TOTAL N (MG/L) | 8.850 -10.450 | 9.637 | 9.630 | ****** -********** | | | 2.120 - 2.860 | 2.463 | 2.470 |
| CHLRPYL A (UG/L) | 11.2 - 25.4 | 18.3 | 18.3 | 1.7 - 19.9 | 7.7 | 3.8 | 13.3 - 41.2 | 24.0 | 17.5 |
| SECCHI (METERS) | 0.5 - 0.6 | 0.5 | 0.5 | 0.3 - 1.5 | 1.0 | 0.9 | 0.2 - 0.3 | 0.3 | 0.3 |

B. Biological characteristics:

1. Phytoplankton -

| Sampling Date | Dominant Genera | Algal Units per ml |
|---|---|---|
| 04/18/74 | 1. Centric diatoms | 9,795 |
| | 2. Stephanodiscus sp. | 1,245 |
| | 3. Synedra sp. | 974 |
| | 4. Cryptomonas sp. | 487 |
| | 5. Ankistrodesmus sp. | 325 |
| | Other genera | 648 |
| | Total | 13,474 |
| 07/08/74 | 1. Nitzschia sp. | 454 |
| | 2. Oscillatoria sp. | 454 |
| | 3. Actinastrum sp. | 363 |
| | 4. Stephanodiscus sp. | 318 |
| | 5. Coelosphaerium sp. | 273 |
| | Other genera | 2,044 |
| | Total | 3,906 |
| 09/24/74 | 1. Cyclotella sp. | 3,213 |
| | 2. Oscillatoria sp. | 771 |
| | 3. Melosira sp. | 707 |
| | 4. Flagellates | 321 |
| | 5. Merismopedia sp. | 193 |
| | Other genera | 1,028 |
| | Total | 6,233 |

2. Chlorophyll a -

| Sampling Date | Station Number | Chlorophyll a (µg/l) |
|---|---|---|
| 04/18/74 | 1 | 25.4 |
| | 2 | 11.2 |
| 07/08/74 | 1 | 1.7 |
| | 3 | 3.8 |
| | 4 | 2.5 |
| | 5 | 10.8 |
| | 6 | 19.9 |
| 09/24/74 | 1 | 13.3 |
| | 2 | 17.5 |
| | 3 | 41.2 |

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

| Spike (mg/l) | Ortho P Conc. (mg/l) | Inorganic N Conc. (mg/l) | Maximum yield (mg/l-dry wt.) |
|---|---|---|---|
| Control | 0.060 | 7.935 | 2.8 |
| 0.050 P | 0.110 | 7.935 | 20.4 |
| 0.050 P + 1.0 N | 0.110 | 8.935 | 21.9 |
| 1.0 N | 0.060 | 8.935 | 2.0 |

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Red Rock Reservoir was high at the time the sample was collected in April. The addition of phosphorus alone produced a significant increase in yield, but no such increase occurred when only nitrogen was added. This indicates limitation by phosphorus.

The reservoir data also indicate phosphorus limitation. The mean inorganic nitrogen to orthophosphorus ratios were 18 to 1 or greater in April and September.

## IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Iowa National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page vi), except for the high runoff months of April and May when two samples were collected. Sampling was begun in August, 1974, and was completed in July, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Iowa District Office of the U.S. Geological Survey for the tributary sites nearest the reservoir.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient concentrations at stations E-1, F-1, G-1, and H-1 and the mean annual ZZ flow.

The operator of the Des Moines wastewater treatment plant provided monthly effluent samples and corresponding flow data. The operators of the wastewater treatment plants of Carlisle, Des Moines Highland Hills, Indianola, Knoxville, Monroe, Pleasantville, and Prairie City did not participate; nutrient loads from these sources were estimated at 1.134 kg P and 3.401 kg N/capita/year, and flows were estimated at 0.3785 $m^3$/capita/day.

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* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal -

| Name | Pop. Served | Treatment | Mean Flow ($m^3/d$) | Receiving Water |
|---|---|---|---|---|
| Carlisle | 1,100 | stab. pond | 416.4 | North River |
| Des Moines | 300,000 | tr. filter | 145,084.2 | Des Moines River |
| Des Moines Highland Hills | 2,600 | tr. filter | 984.1 | Middle Cr./ Raccoon River |
| Indianola | 6,500 | tr. filter | 2,460.2 | Trib. of Middle River |
| Knoxville | 4,000 | tr. filter | 1,514.0 | Competine Cr. |
| Monroe - South Plant | 350 | stab. pond | 132.5 | Brush Cr./Red Rock Res. |
| Pleasantville | 800 | stab. pond | 302.8 | Coal Cr. |
| Prairie City | 900 | tr. filter | 340.6 | Calhoun Cr. |

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

| Source | kg P/ yr | % of total |
|---|---|---|
| a. Tributaries (non-point load) - | | |
| Des Moines River | 1,957,190 | 78.4 |
| White Breast Creek | 77,035 | 3.1 |
| Calhoun Creek | 3,980 | 0.2 |
| b. Minor tributaries & immediate drainage (non-point load) - | 31,730 | 1.3 |
| c. Known municipal STP's - | | |
| Carlisle | 1,245 | 0.1 |
| Des Moines | 408,740 | 16.4 |
| Des Moines Highland Hills | 2,950 | 0.1 |
| Indianola | 7,370 | 0.3 |
| Knoxville | 4,535 | 0.2 |
| Monroe - South Plant | 395 | <0.1 |
| Pleasantville | 905 | <0.1 |
| Prairie City | 1,020 | <0.1 |
| d. Septic tanks - None | - | - |
| e. Known industrial - None | - | - |
| f. Direct precipitation* - | 635 | <0.1 |
| Total | 2,497,730 | 100.0 |

2. Outputs -

Lake outlet - Des Moines River 978,530

3. Net annual P accumulation - 1,519,200 kg.

* See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

| Source | kg N/ yr | % of total |
|---|---|---|
| a. Tributaries (non-point load) - | | |
| Des Moines River | 27,428,755 | 91.2 |
| White Breast Creek | 673,045 | 2.2 |
| Calhoun Creek | 91,735 | 0.3 |
| b. Minor tributaries & immediate drainage (non-point load) - | 668,705 | 2.2 |
| c. Known municipal STP's - | | |
| Carlisle | 3,740 | <0.1 |
| Des Moines | 1,104,540 | 3.7 |
| Des Moines Highland Hills | 8,845 | <0.1 |
| Indianola | 22,105 | 0.1 |
| Knoxville | 13,605 | <0.1 |
| Monroe - South Plant | 1,190 | <0.1 |
| Pleasantville | 2,720 | <0.1 |
| Prairie City | 3,060 | <0.1 |
| d. Septic tanks - None | - | - |
| e. Known industrial - None | - | - |
| f. Direct precipitation** - | 39,105 | 0.1 |
| Total | 30,061,150 | 100.0 |

2. Outputs -

Lake outlet - Des Moines River 22,386,480

3. Net annual N accumulation - 7,667,825 kg.

* See Working Paper No. 175.

D. Non-point Nutrient Export by Subdrainage Area:

| Tributary | kg P/km²/yr | kg N/km²/yr |
|---|---|---|
| Des Moines River | 65 | 909 |
| White Breast Creek | 78 | 684 |
| Calhoun Creek | 68 | 1,560 |

E. Mean Nutrient Concentration in Ungaged Streams:

| Tributary | Mean Total P Conc. (mg/l) | Mean Total N Conc. (mg/l) |
|---|---|---|
| Competine Creek* | 4.244 | 9.648 |
| Walnut Creek | 0.300 | 7.383 |
| Hawk Run | 0.173 | 4.193 |
| Prairie Creek | 0.391 | 6.889 |
| Butcher Creek | 0.185 | 3.625 |

* Sampling site downstream from Knoxville STP.

F. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

| | Total Phosphorus | | Total Nitrogen | |
|---|---|---|---|---|
| | Total | Accumulated | Total | Accumulated |
| grams/$m^2$/yr | 68.96 | 41.94 | 830.0 | 211.7 |

Vollenweider phosphorus loadings (g/m2/yr) based on mean depth and mean hydraulic retention time of Red Rock Reservoir:

| | |
|---|---|
| "Dangerous" (eutrophic loading) | 1.94 |
| "Permissible" (oligotrophic loading) | 0.97 |

## V. LITERATURE REVIEWED

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# VI. APPENDICES

## APPENDIX A

## LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

| LAKE CODE | LAKE NAME | MEDIAN TOTAL P | MEDIAN INORG N | SSD-MEAN SEC | MEAN CHLORA | 1S-MIN DO | MEDIAN DISS ORTHO P |
|---|---|---|---|---|---|---|---|
| 1901 | LAKE ACQUABI | 0.062 | 0.335 | 469.333 | 8.600 | 8.200 | 0.009 |
| 1902 | BIG CREEK RESERVOIR | 0.046 | 6.465 | 438.500 | 16.867 | 14.800 | 0.011 |
| 1903 | BLACK HAWK LAKE | 0.185 | 0.130 | 488.167 | 49.740 | 15.000 | 0.020 |
| 1904 | CLEAR LAKE | 0.059 | 0.070 | 465.125 | 17.400 | 8.600 | 0.010 |
| 1905 | LAKE DARLING | 0.077 | 1.475 | 482.500 | 13.817 | 9.200 | 0.012 |
| 1906 | LOST ISLAND LAKE | 0.146 | 0.065 | 421.167 | 36.100 | 8.400 | 0.021 |
| 1907 | LAKE MACBRIDE | 0.061 | 2.035 | 458.444 | 17.067 | 15.000 | 0.010 |
| 1908 | PRAIRIE ROSE LAKE | 0.056 | 0.210 | 463.667 | 17.350 | 8.600 | 0.010 |
| 1909 | RATHBUN RESERVOIR | 0.071 | 1.170 | 475.889 | 12.039 | 14.000 | 0.008 |
| 1910 | RED ROCK LAKE | 0.180 | 1.880 | 473.400 | 14.730 | 14.000 | 0.104 |
| 1911 | ROCK CREEK LAKE | 0.065 | 1.400 | 480.500 | 18.367 | 8.400 | 0.007 |
| 1912 | SILVER LAKE | 0.193 | 0.565 | 482.667 | 95.300 | 10.000 | 0.034 |
| 1913 | SPIRIT LAKE | 0.041 | 0.090 | 422.667 | 12.622 | 9.000 | 0.007 |
| 1914 | VIKING LAKE | 0.075 | 0.130 | 459.000 | 26.033 | 14.200 | 0.017 |
| 1915 | WEST LAKE OKOBOJI | 0.046 | 0.060 | 380.444 | 7.722 | 15.000 | 0.017 |

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

| LAKE CODE | LAKE NAME | MEDIAN TOTAL P | MEDIAN INORG N | 500-MEAN SEC | MEAN CHLORA | 15-MIN DO | MEDIAN DISS ORTHO P | INDEX NO |
|---|---|---|---|---|---|---|---|---|
| 1901 | LAKE ACQUABI | 57 ( 8) | 50 ( 7) | 43 ( 6) | 93 ( 13) | 100 ( 14) | 79 ( 11) | 422 |
| 1902 | BIG CREEK RESERVOIR | 89 ( 12) | 0 ( 0) | 79 ( 11) | 57 ( 8) | 21 ( 3) | 50 ( 7) | 296 |
| 1903 | BLACK HAWK LAKE | 7 ( 1) | 68 ( 9) | 0 ( 0) | 7 ( 1) | 7 ( 0) | 21 ( 3) | 110 |
| 1904 | CLEAR LAKE | 71 ( 10) | 86 ( 12) | 50 ( 7) | 36 ( 5) | 75 ( 10) | 64 ( 8) | 382 |
| 1905 | LAKE DARLING | 29 ( 4) | 21 ( 3) | 14 ( 2) | 71 ( 10) | 57 ( 8) | 43 ( 6) | 235 |
| 1906 | LOST ISLAND LAKE | 21 ( 3) | 93 ( 13) | 93 ( 13) | 14 ( 2) | 89 ( 12) | 14 ( 2) | 324 |
| 1907 | LAKE MACBRIDE | 64 ( 9) | 7 ( 1) | 71 ( 10) | 50 ( 7) | 7 ( 0) | 64 ( 8) | 263 |
| 1908 | PRAIRIE ROSE LAKE | 79 ( 11) | 57 ( 8) | 57 ( 8) | 43 ( 6) | 75 ( 10) | 64 ( 8) | 375 |
| 1909 | RATHBUN RESERVOIR | 43 ( 6) | 36 ( 5) | 29 ( 4) | 86 ( 12) | 39 ( 5) | 86 ( 12) | 319 |
| 1910 | RED ROCK LAKE | 14 ( 2) | 14 ( 2) | 36 ( 5) | 64 ( 9) | 39 ( 5) | 0 ( 0) | 167 |
| 1911 | ROCK CREEK LAKE | 50 ( 7) | 29 ( 4) | 21 ( 3) | 29 ( 4) | 89 ( 12) | 96 ( 13) | 314 |
| 1912 | SILVER LAKE | 0 ( 0) | 43 ( 6) | 7 ( 1) | 0 ( 0) | 50 ( 7) | 7 ( 1) | 107 |
| 1913 | SPIRIT LAKE | 100 ( 14) | 79 ( 11) | 86 ( 12) | 79 ( 11) | 64 ( 9) | 96 ( 13) | 504 |
| 1914 | VIKING LAKE | 36 ( 5) | 68 ( 9) | 64 ( 9) | 21 ( 3) | 29 ( 4) | 32 ( 4) | 250 |
| 1915 | WEST LAKE OKOBOJI | 89 ( 12) | 100 ( 14) | 100 ( 14) | 100 ( 14) | 7 ( 0) | 32 ( 4) | 428 |

LAKES RANKED BY INDEX NOS.

| RANK | LAKE CODE | LAKE NAME | INDEX NO |
|---|---|---|---|
| 1 | 1913 | SPIRIT LAKE | 504 |
| 2 | 1915 | WEST LAKE OKOBOJI | 428 |
| 3 | 1901 | LAKE ACQUABI | 422 |
| 4 | 1904 | CLEAR LAKE | 382 |
| 5 | 1908 | PRAIRIE ROSE LAKE | 375 |
| 6 | 1906 | LOST ISLAND LAKE | 324 |
| 7 | 1909 | RATHBUN RESERVOIR | 319 |
| 8 | 1911 | ROCK CREEK LAKE | 314 |
| 9 | 1902 | BIG CREEK RESERVOIR | 296 |
| 10 | 1907 | LAKE MACBRIDE | 263 |
| 11 | 1914 | VIKING LAKE | 250 |
| 12 | 1905 | LAKE DARLING | 235 |
| 13 | 1910 | RED ROCK LAKE | 167 |
| 14 | 1903 | BLACK HAWK LAKE | 110 |
| 15 | 1912 | SILVER LAKE | 107 |

# APPENDIX B

## CONVERSION FACTORS

## CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x $8.107 \times 10^{-4}$ = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

# APPENDIX C

## TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR IOWA 12/23/75

LAKE CODE 1910 RED ROCK RES.

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 31916.6

| TRIBUTARY | SUB-DRAINAGE AREA(SQ KM) | NORMALIZED FLOWS(CMS) JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | MEAN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1910A1 | 31916.6 | 44.17 | 80.70 | 207.28 | 238.43 | 192.27 | 249.47 | 127.14 | 73.91 | 79.85 | 60.31 | 60.60 | 39.08 | 121.04 |
| 1910A2 | 30186.4 | 41.91 | 76.17 | 195.95 | 225.40 | 181.79 | 235.88 | 120.86 | 69.94 | 75.61 | 57.20 | 57.48 | 36.81 | 114.46 |
| 1910A3 | 25586.6 | 26.90 | 51.17 | 167.78 | 243.35 | 190.35 | 251.06 | 133.66 | 70.25 | 61.28 | 49.58 | 40.27 | 26.33 | 109.37 |
| 1910C1 | 984.2 | 2.23 | 8.38 | 13.88 | 9.03 | 9.74 | 8.86 | 3.71 | 1.80 | 3.71 | 0.97 | 3.09 | 1.05 | 5.51 |
| 1910D1 | 58.8 | 0.13 | 0.50 | 0.83 | 0.54 | 0.58 | 0.53 | 0.22 | 0.11 | 0.22 | 0.06 | 0.18 | 0.06 | 0.33 |
| 1910ZZ | 686.3 | 1.55 | 5.83 | 9.68 | 6.31 | 6.80 | 6.17 | 2.59 | 1.25 | 2.59 | 0.67 | 2.15 | 0.74 | 3.84 |

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 31916.6
SUM OF SUB-DRAINAGE AREAS = 57502.4
TOTAL FLOW IN = 2802.95
TOTAL FLOW OUT = 1453.22

NOTE *** USE A3 FOR INLET. A2 IS SUPLEMENTAL FLOW DATA FOR DES MOINES RIVER.

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|---|---|---|---|---|---|---|---|---|---|
| 1910A1 | 8 | 74 | 119.78 | 17 | 99.11 | | | | |
| | 9 | 74 | 23.39 | 14 | 25.15 | | | | |
| | 10 | 74 | 15.49 | 5 | 15.01 | | | | |
| | 11 | 74 | 48.14 | 3 | 70.79 | | | | |
| | 12 | 74 | 35.96 | 14 | 36.25 | | | | |
| | 1 | 75 | 35.11 | 11 | 28.32 | | | | |
| | 2 | 75 | 32.00 | 8 | 27.18 | | | | |
| | 3 | 75 | 158.01 | 8 | 40.21 | | | | |
| | 4 | 75 | 436.08 | 13 | 450.24 | 20 | 370.95 | | |
| | 5 | 75 | 311.49 | 3 | 142.43 | 20 | 515.37 | | |
| | 6 | 75 | 455.90 | 1 | 467.23 | 15 | 492.71 | 28 | 487.05 |
| | 7 | 75 | 219.17 | 18 | 274.39 | | | | |
| 1910A2 | 8 | 74 | 45.31 | 18 | 50.97 | | | | |
| | 9 | 74 | 21.52 | 14 | 31.15 | | | | |
| | 10 | 74 | 17.56 | 5 | 14.44 | | | | |
| | 11 | 74 | 30.02 | 2 | 54.09 | | | | |
| | 12 | 74 | 18.69 | 14 | 21.80 | 15 | 26.05 | | |
| | 1 | 75 | 16.14 | 11 | 9.91 | 18 | 17.84 | | |
| | 2 | 75 | 18.12 | 8 | 17.27 | 22 | 16.14 | | |
| | 3 | 75 | 187.74 | 8 | 19.26 | 16 | 19.54 | | |
| | 4 | 75 | 433.25 | 7 | 276.94 | 13 | 478.55 | 20 | 430.42 |
| | 5 | 75 | 311.49 | 3 | 142.43 | 20 | 515.37 | | |
| | 6 | 75 | 455.90 | 1 | 467.23 | 15 | 492.71 | 28 | 487.05 |
| | 7 | 75 | 219.17 | 18 | 274.39 | | | | |

TRIBUTARY FLOW INFORMATION FOR IOWA 12/23/75

LAKE CODE 1910 RED ROCK RES.

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|---|---|---|---|---|---|---|---|---|---|
| 1910A3 | 8 | 74 | 37.66 | 17 | 43.84 | | | | |
| | 9 | 74 | 18.15 | 14 | 25.80 | | | | |
| | 10 | 74 | 14.78 | 5 | 12.29 | | | | |
| | 11 | 74 | 25.34 | 2 | 45.87 | | | | |
| | 12 | 74 | 15.94 | 15 | 21.97 | | | | |
| | 1 | 75 | 13.65 | 18 | 15.01 | | | | |
| | 2 | 75 | 15.38 | 22 | 13.59 | | | | |
| | 3 | 75 | 159.14 | 16 | 16.54 | | | | |
| | 4 | 75 | 368.12 | 7 | 234.75 | 20 | 365.29 | | |
| | 5 | 75 | 368.12 | 3 | 880.65 | 17 | 288.83 | | |
| | 6 | 75 | 421.92 | 8 | 237.86 | 21 | 555.01 | | |
| | 7 | 75 | 110.15 | 18 | 73.91 | | | | |
| 1910C1 | 8 | 74 | 0.40 | 18 | 0.59 | | | | |
| | 9 | 74 | 0.16 | 14 | 0.34 | | | | |
| | 10 | 74 | 1.64 | 5 | 0.19 | | | | |
| | 11 | 74 | 0.59 | 2 | 7.31 | | | | |
| | 12 | 74 | 2.21 | 8 | 7.25 | 14 | 2.66 | | |
| | 1 | 75 | 3.45 | 11 | 22.03 | | | | |
| | 2 | 75 | 2.83 | 8 | 0.62 | | | | |
| | 3 | 75 | 15.74 | | | | | | |
| | 4 | 75 | 9.63 | 13 | 6.43 | 20 | 8.78 | | |
| | 5 | 75 | 4.87 | 3 | 3.85 | 20 | 1.10 | | |
| | 6 | 75 | 13.51 | 15 | 3.45 | 28 | 52.67 | | |
| | 7 | 75 | 1.42 | 13 | 0.37 | | | | |
| 1910D1 | 8 | 74 | 0.06 | 18 | 0.06 | | | | |
| | 9 | 74 | 0.02 | 14 | 0.05 | | | | |
| | 10 | 74 | 0.06 | 5 | 0.01 | | | | |
| | 11 | 74 | 0.10 | 2 | 0.23 | | | | |
| | 12 | 74 | 0.13 | 14 | 0.12 | | | | |
| | 1 | 75 | 0.07 | 11 | 0.19 | | | | |
| | 2 | 75 | 0.21 | 8 | 0.04 | | | | |
| | 3 | 75 | 0.82 | 8 | 0.11 | | | | |
| | 4 | 75 | 0.62 | 13 | 0.31 | 20 | 0.59 | | |
| | 5 | 75 | 0.20 | 4 | 0.19 | 17 | 0.11 | 31 | 0.65 |
| | 6 | 75 | 0.45 | 13 | 0.25 | 28 | 0.45 | | |
| | 7 | 75 | 0.06 | 18 | 0.02 | | | | |
| 1910Z2 | 8 | 74 | 0.31 | | | | | | |
| | 9 | 74 | 0.12 | | | | | | |
| | 10 | 74 | 1.13 | | | | | | |
| | 11 | 74 | 0.45 | | | | | | |
| | 12 | 74 | 1.53 | | | | | | |
| | 1 | 75 | 2.32 | | | | | | |
| | 2 | 75 | 2.01 | | | | | | |
| | 3 | 75 | 10.90 | | | | | | |
| | 4 | 75 | 6.74 | | | | | | |
| | 5 | 75 | 3.34 | | | | | | |
| | 6 | 75 | 9.17 | | | | | | |
| | 7 | 75 | 0.96 | | | | | | |

# APPENDIX D

# PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/12/23

191001
41 22 09.0 092 58 31.0
RED ROCK LAKE
19125 IOWA

11EPALES
3

2111202
0033 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00610 NH3-N TOTAL MG/L | 00625 TOT KJEL N MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74/04/18 | 15 30 | 0000 | 13.6 | | 24 | 555 | 8.55 | 330 | 0.050 | 0.800 | 8.050 | 0.104 |
| | 15 30 | 0005 | 13.6 | 12.4 | | 555 | 8.50 | 370 | 0.040 | 0.600 | 9.250 | 0.115 |
| | 15 30 | 0015 | 12.6 | 12.4 | | 542 | 8.40 | 340 | 0.030 | 0.700 | 8.170 | 0.116 |
| | 15 30 | 0028 | 11.1 | 10.4 | | 517 | 8.30 | 350 | 0.050 | 0.700 | 8.710 | 0.118 |
| 74/07/08 | 11 00 | 0000 | 24.2 | 6.4 | 60 | 579 | 8.10 | | | | | |
| | 11 00 | 0005 | 23.7 | 7.0 | | 573 | 8.10 | | | | | |
| | 11 00 | 0015 | 23.2 | 6.0 | | 540 | 8.10 | | | | | |
| | 11 00 | 0030 | 23.0 | 5.2 | | 571 | 8.00 | | | | | |
| | 11 00 | 0045 | 22.4 | 4.2 | | 566 | 7.90 | | | | | |
| | 11 00 | 0062 | 20.5 | 2.8 | | 550 | 7.80 | | | | | |
| 74/09/24 | 15 20 | 0000 | 16.8 | 8.0 | 12 | 536 | 7.53 | 254 | 0.040 | 0.600 | 1.840 | 0.075 |
| | 15 20 | 0005 | 16.8 | 8.0 | | 536 | 7.53 | 238 | 0.050 | 0.900 | 1.570 | 0.069 |
| | 15 20 | 0015 | 16.8 | 7.4 | | 531 | 7.52 | 228 | 0.040 | 0.900 | 1.600 | 0.065 |
| | 15 20 | 0032 | 16.7 | 7.4 | | 535 | 7.50 | 234 | 0.060 | 1.000 | 1.660 | 0.064 |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00665 PHOS-TOT MG/L P | 32217 CHLRPHYL A UG/L | 00031 INCDT LT REMNING PERCENT |
|---|---|---|---|---|---|
| 74/04/18 | 15 30 | 0000 | 0.190 | 25.4 | |
| | 15 30 | 0005 | 0.178 | | |
| | 15 30 | 0015 | 0.180 | | |
| | 15 30 | 0028 | 0.178 | | |
| 74/07/08 | 11 00 | 0000 | | 1.7 | |
| | 11 00 | 0002 | | | 50.0 |
| | 11 00 | 0015 | | | 1.0 |
| 74/09/24 | 15 20 | 0000 | 0.176 | 13.3 | |
| | 15 20 | 0001 | | | 1.0 |
| | 15 20 | 0005 | 0.175 | | |
| | 15 20 | 0015 | 0.179 | | |
| | 15 20 | 0032 | 0.208 | | |

STORET RETRIEVAL DATE 75/12/23

191002
41 24 08.0 093 00 53.0
RED ROCK LAKE
19125 IOWA

11EPALES
3

2111202
0024 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00610 NH3-N TOTAL MG/L | 00625 TOT KJEL N MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74/04/18 | 15 50 | 0000 | 11.4 | | 18 | 560 | 8.20 | 380 | 0.070 | 0.600 | 9.640 | 0.131 |
| | 15 50 | 0005 | 11.2 | 9.8 | | 561 | 8.20 | 330 | 0.080 | 0.600 | 8.640 | 0.135 |
| | 15 50 | 0015 | 11.0 | 10.0 | | 617 | 8.20 | 370 | 0.070 | 0.700 | 9.750 | 0.134 |
| | 15 50 | 0021 | 10.5 | 10.0 | | 612 | 8.30 | 390 | 0.070 | 0.700 | 9.490 | 0.128 |
| 74/09/24 | 14 55 | 0000 | 16.8 | 8.0 | 12 | 534 | 7.60 | 224 | 0.050 | 0.700 | 1.600 | 0.080 |
| | 14 55 | 0005 | 16.8 | 8.4 | | 535 | 7.58 | 210 | 0.070 | 0.600 | 1.520 | 0.072 |
| | 14 55 | 0015 | 16.7 | 8.2 | | 535 | 7.61 | 240 | 0.040 | 0.600 | 1.700 | 0.070 |
| | 14 55 | 0020 | 16.7 | 8.2 | | 535 | 7.58 | 254 | 0.050 | 0.700 | 1.820 | 0.062 |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00665 PHOS-TOT MG/L P | 32217 CHLRPHYL A UG/L | 00031 INCDT LT REMNING PERCENT |
|---|---|---|---|---|---|
| 74/04/18 | 15 50 | 0000 | 0.201 | 11.2 | |
| | 15 50 | 0005 | 0.211 | | |
| | 15 50 | 0015 | 0.212 | | |
| | 15 50 | 0021 | 0.210 | | |
| 74/09/24 | 14 55 | 0000 | 0.176 | 17.5 | |
| | 14 55 | 0001 | | | 1.0 |
| | 14 55 | 0005 | 0.155 | | |
| | 14 55 | 0015 | 0.167 | | |
| | 14 55 | 0020 | 0.180 | | |

STORET RETRIEVAL DATE 75/12/23

191003
41 24 49.0 093 06 04.0
RED ROCK LAKE
19125 IOWA

11EPALES
3

2111202
0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00610 NH3-N TOTAL MG/L | 00625 TOT KJEL N MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74/07/08 | 14 05 | 0000 | 25.4 | 9.3 | 48 | 606 | 8.20 | | | | | |
| | 14 05 | 0005 | 24.8 | 7.8 | | 613 | 8.10 | | | | | |
| | 14 05 | 0015 | 24.3 | 7.0 | | 631 | 8.10 | | | | | |
| | 14 05 | 0030 | 23.6 | 6.6 | | 653 | 8.00 | | | | | |
| | 14 05 | 0045 | 21.1 | 2.2 | | 580 | 7.60 | | | | | |
| 74/09/24 | 14 35 | 0000 | 17.9 | 9.0 | 8 | 598 | 7.53 | 238 | 0.340 | 1.500 | 1.360 | 0.265 |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00665 PHOS-TOT MG/L P | 32217 CHLRPHYL A UG/L | 00031 INCDT LT REMNING PERCENT |
|---|---|---|---|---|---|
| 74/07/08 | 14 05 | 0000 | | 3.8 | |
| 74/09/24 | 14 35 | 0000 | 0.670 | 41.2 | |
| | 14 35 | 0001 | | | 1.0 |

STORET RETRIEVAL DATE 75/12/23

191004
41 22 43.0 093 03 10.0
RED ROCK LAKE
19125 IOWA

11EPALES
3

2111202
0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00610 NH3-N TOTAL MG/L | 00625 TOT KJEL N MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74/07/08 | 14 30 | 0000 | 28.1 | 10.4 | 36 | 434 | 8.40 | | | | | |
| | 14 30 | 0005 | 27.3 | 8.6 | | 525 | 8.40 | | | | | |
| | 14 30 | 0015 | 23.5 | 6.0 | | 580 | 8.00 | | | | | |
| | 14 30 | 0025 | 23.4 | 6.6 | | 576 | 8.00 | | | | | |
| | 14 30 | 0032 | 21.6 | 5.4 | | 455 | 7.80 | | | | | |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00665 PHOS-TOT MG/L P | 32217 CHLRPHYL A UG/L | 00031 INCDT LT REMNING PERCENT |
|---|---|---|---|---|---|
| 74/07/08 | 14 30 | 0000 | | 2.5 | |
| | 14 30 | 0006 | | | 1.0 |

STORET RETRIEVAL DATE 75/12/23

191005
41 28 03.0 093 12 46.0
RED ROCK LAKE
19 IOWA

11EPALES
3

2111202
0047 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00610 NH3-N TOTAL MG/L | 00625 TOT KJEL N MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74/07/08 | 13 30 | 0000 | 28.4 | 10.8 | 36 | 722 | 8.60 | | | | | |
| | 13 30 | 0005 | 28.3 | 10.2 | | 721 | 8.60 | | | | | |
| | 13 30 | 0015 | 26.2 | 8.0 | | 696 | 8.00 | | | | | |
| | 13 30 | 0020 | 23.8 | 3.8 | | 708 | 7.80 | | | | | |
| | 13 30 | 0030 | 23.3 | 3.6 | | 658 | 7.80 | | | | | |
| | 13 30 | 0043 | 21.7 | 1.0 | | 594 | 7.60 | | | | | |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00665 PHOS-TOT MG/L P | 32217 CHLRPHYL A UG/L | 00031 INCDT LT REMNING PERCENT |
|---|---|---|---|---|---|
| 74/07/08 | 13 30 | 0000 | | 10.8 | |
| | 13 30 | 0007 | | | 1.0 |

STORET RETRIEVAL DATE 75/12/23

191006
41 29 20.0 093 20 12.0
RED ROCK LAKE
19 IOWA

11EPALES 2111202
3 0020 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00610 NH3-N TOTAL MG/L | 00625 TOT KJEL N MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74/07/08 | 13 00 | 0000 | 26.2 | 9.4 | 12 | 792 | 8.40 | | | | | |
| | 13 00 | 0005 | 27.6 | 7.8 | | 788 | 8.30 | | | | | |
| | 13 00 | 0015 | 26.5 | 6.2 | | 760 | 8.20 | | | | | |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00665 PHOS-TOT MG/L P | 32217 CHLRPHYL A UG/L | 00031 INCDT LT REMNING PERCENT |
|---|---|---|---|---|---|
| 74/07/08 | 13 00 | 0006 | | 19.9 | |
| | 13 00 | 0002 | | | 1.0 |

# APPENDIX E

## TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 76/01/27

1910A1
41 31 40.0 092 58 00.0
DES MOINES RIVER
19007 15 PELLA IA
O/RED ROCK RESERVOIR
LGHT DTY RD BRDG .75 MI DWNST RM OF DAM
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/08/18 | 09 53 | | 2.700 | 1.300 | 0.080 | 0.065 | 0.130 |
| 74/09/14 | 10 50 | | 1.440 | 1.400 | 0.040 | 0.070 | 0.165 |
| 74/10/05 | 10 45 | | 1.520 | 0.925 | 0.065 | 0.090 | 0.187 |
| 74/11/03 | 09 15 | | 1.520 | 0.900 | 0.065 | 0.110 | 0.200 |
| 74/12/14 | 11 20 | | 1.560 | 1.600 | 0.055 | 0.153 | 0.330 |
| 75/01/11 | 11 00 | | 2.500 | 1.400 | 0.144 | 0.250 | 0.340 |
| 75/02/08 | 13 45 | | 1.150 | 1.400 | 0.528 | 0.336 | 0.340 |
| 75/03/08 | 09 35 | | 2.400 | 2.200 | 0.763 | 0.430 | 0.520 |
| 75/04/13 | 12 50 | | 6.000 | 1.300 | 0.300 | 0.115 | 0.180 |
| 75/04/20 | 15 25 | | 7.600 | 1.200 | 0.185 | 0.150 | 0.240 |
| 75/05/04 | 13 50 | | 7.100 | 1.200 | 0.350 | 0.035 | 0.160 |
| 75/05/20 | 15 15 | | 7.800 | 1.750 | 0.050 | 0.105 | 0.250 |
| 75/05/31 | 14 30 | | 6.900 | 2.300 | 0.145 | 0.095 | 0.180 |
| 75/06/28 | 11 20 | | 7.800 | 1.200 | 0.060 | 0.105 | 0.180 |
| 75/07/13 | 08 30 | | 7.800 | 1.700 | 0.185 | 0.145 | 0.260 |
| 75/07/18 | 07 45 | | 7.200 | 1.000 | 0.095 | 0.135 | 0.220 |

STORET RETRIEVAL DATE 76/01/27

1910A2
41 20 13.0 093 29 17.0
DES MOINES RIVER
19 7.5 PLEASANTVILE
T/RED ROCK RESERVOIR
MED DTY RD BRDG 7 MI NNW OF PLEASANTVILE
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/08/18 | 14 | 24 | 0.990 | 2.400 | 0.140 | 0.190 | 0.610 |
| 74/09/14 | 15 | 20 | 1.200 | 2.300 | 0.315 | 0.380 | 0.680 |
| 74/10/05 | 14 | 30 | 0.910 | 2.300 | 0.330 | 0.290 | 0.550 |
| 74/11/02 | 14 | 20 | 1.040 | 2.900 | 0.280 | 0.185 | 1.030 |
| 74/12/14 | 14 | 30 | 2.640 | 2.000 | 0.460 | 0.500 | 0.750 |
| 75/01/11 | 13 | 00 | 1.560 | 4.400 | 0.368 | 0.070 | 0.230 |
| 75/02/08 | 13 | 25 | 2.630 | 1.400 | 0.600 | 0.480 | 0.500 |
| 75/03/08 | 10 | 20 | 3.000 | 1.700 | 0.730 | 0.480 | 0.580 |
| 75/04/13 | 12 | 40 | 7.500 | 2.400 | 0.210 | 0.190 | 0.720 |
| 75/04/20 | 15 | 25 | 8.000 | 1.850 | 0.080 | 0.190 | 0.560 |
| 75/05/03 | 13 | 25 | 6.500 | 3.750 | 0.050 | 0.165 | 1.600 |
| 75/05/20 | 16 | 50 | 8.600 | 1.700 | 0.035 | 0.160 | 0.420 |
| 75/06/01 | 08 | 35 | 10.500 | 2.350 | 0.065 | 0.175 | 0.500 |
| 75/06/15 | 16 | 05 | 12.000 | 2.600 | 0.044 | 0.155 | 0.760 |
| 75/07/13 | 12 | 45 | 5.600 | 2.200 | 0.125 | 0.125 | 0.380 |

STORET RETRIEVAL DATE 76/01/27

1910A3
41 34 35.0 093 35 49.0
DES MOINES RIVER
19 7.5 DS MOINES SE
T/RED ROCK RESERVOIR
HWY 65/69 BRDG UPSTRM OF DES MOINES STP
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/08/18 | 11 30 | | 0.670 | 3.000 | 0.270 | 0.045 | 0.240 |
| 74/09/14 | 12 05 | | 0.432 | 1.800 | 0.100 | 0.035 | 0.180 |
| 74/10/05 | 11 00 | | 0.144 | 1.800 | 0.015 | 0.045 | 0.220 |
| 74/11/02 | 11 50 | | 1.280 | 2.500 | 0.105 | 0.135 | 0.520 |
| 74/12/15 | 11 20 | | 1.970 | 1.300 | 0.140 | 0.100 | 0.210 |
| 75/02/22 | 10 30 | | 2.240 | 1.500 | 0.552 | 0.256 | 0.350 |
| 75/03/16 | 10 15 | | 2.880 | 1.100 | 0.410 | 0.250 | 0.280 |
| 75/04/13 | 11 00 | | 6.600 | 2.400 | 0.310 | 0.180 | 0.630 |
| 75/04/20 | 10 00 | | 8.500 | 1.480 | 0.063 | 0.175 | 0.400 |
| 75/05/03 | 11 35 | | 9.100 | 2.100 | 0.065 | 0.180 | 0.600 |
| 75/06/08 | 13 30 | | 11.000 | 2.800 | 0.115 | 0.140 | 0.660 |
| 75/06/21 | 13 05 | | 11.000 | 1.780 | 0.070 | 0.170 | 0.530 |

STORET RETRIEVAL DATE 76/01/27

191081
41 20 08.0 093 03 45.0
COMPETINE CREEK
19 7.5 KNOXVILLE IA
T/RED ROCK RESERVOIR
100 FT DNSTRM LTDTY RD BRDG ENE KNOXVILL
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/08/18 | 09 20 | | 2.700 | 5.200 | 2.900 | 4.900 | 6.000 |
| 74/09/14 | 10 00 | | 3.840 | 6.700 | 4.100 | 3.400 | 5.400 |
| 74/10/05 | 10 00 | | 1.760 | 9.500 | 6.800 | 6.200 | 9.800 |
| 74/11/03 | 09 00 | | 3.600 | 4.800 | 2.880 | 2.600 | 3.700 |
| 74/12/14 | 10 45 | | 2.600 | 9.200 | 2.900 | 2.300 | 3.900 |
| 75/01/11 | 10 35 | | 2.760 | 4.400 | 2.360 | 1.700 | 2.600 |
| 75/02/22 | 13 15 | | 1.760 | 13.500 | 9.100 | 3.300 | 6.000 |
| 75/03/08 | 09 00 | | 1.570 | 7.700 | 3.500 | 1.350 | 2.100 |
| 75/04/13 | 12 15 | | 2.600 | 2.800 | 1.300 | 0.940 | 1.250 |
| 75/04/20 | 13 45 | | 2.600 | 2.900 | 1.250 | 1.300 | 1.500 |
| 75/05/03 | 16 25 | | 2.300 | 4.400 | 2.100 | 2.300 | 2.600 |
| 75/05/20 | 15 35 | | 2.880 | 11.970 | 6.100 | 2.000 | |
| 75/05/31 | 15 00 | | 6.900 | 2.300 | 0.790 | 0.840 | 1.050 |
| 75/06/13 | 08 40 | | 4.000 | 3.450 | 1.760 | 2.300 | 2.600 |
| 75/06/28 | 11 45 | | 2.700 | 3.450 | 1.500 | 2.880 | 3.600 |
| 75/07/13 | 08 00 | | 4.500 | 9.750 | 5.900 | 3.200 | 8.100 |
| 75/07/18 | 08 15 | | 3.525 | 9.400 | 6.000 | 6.400 | 7.500 |

STORET RETRIEVAL DATE 76/01/27

1910C1
41 19 20.0 093 09 00.0
WHITE BREST CREEK
19 7.5 KNOXVILLE SW
T/RED ROCK RESERVOIR
IA HWY 60/92 BRDG 3.0 MI W OF KNOXVILLE
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/08/18 | 13 21 | | 0.860 | 2.300 | 0.360 | 0.045 | 0.045 |
| 74/09/14 | 14 15 | | 0.510 | 1.800 | 0.290 | 0.045 | 0.350 |
| 74/10/05 | 13 00 | | 0.016 | 2.100 | 0.055 | 0.050 | 0.230 |
| 74/11/02 | 13 10 | | 1.760 | 3.600 | 0.340 | 0.085 | 0.825 |
| 75/01/11 | 14 00 | | 1.840 | 5.700 | 0.320 | 0.070 | |
| 75/03/08 | 10 00 | | 1.150 | 1.950 | 0.775 | 0.100 | 0.290 |
| 75/04/13 | 12 05 | | 1.650 | 1.350 | 0.260 | 0.060 | 0.370 |
| 75/04/20 | 14 45 | | 1.100 | 1.400 | 0.170 | 0.075 | 0.420 |
| 75/05/03 | 12 45 | | 0.900 | 1.700 | 0.110 | 0.050 | 0.420 |
| 75/05/20 | 16 15 | | 0.040 | 1.700 | 0.030 | 0.037 | 0.380 |
| 75/06/15 | 15 20 | | 3.850 | 2.800 | 0.120 | 0.070 | 0.800 |
| 75/06/28 | 12 00 | | 0.005 | 2.600 | 0.055 | 0.060 | 0.340 |
| 75/07/13 | 12 00 | | 0.075 | 1.850 | 0.135 | 0.075 | 0.520 |

STORET RETRIEVAL DATE 76/01/27

1910D1
41 28 47.0 093 09 42.0
CALHOUN CREEK
19 7.5 KNOXVILLE NW
T/RED ROCK RESERVOIR
2NDRY RD BRDG 9.1 MI SE OF PRAIRIE CITY
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/08/18 | 10 44 | | 6.900 | 1.200 | 0.095 | 0.155 | 0.330 |
| 74/09/14 | 12 20 | | 3.680 | 4.000 | 0.760 | 0.550 | 0.880 |
| 74/10/05 | 11 30 | | 0.820 | 2.000 | 0.130 | 0.060 | 0.260 |
| 74/11/02 | 10 00 | | 3.360 | 2.800 | 1.200 | 0.860 | 0.900 |
| 74/12/14 | 13 15 | | 3.600 | 0.600 | 0.560 | 0.510 | 0.780 |
| 75/01/11 | 13 05 | | 2.880 | 4.600 | 1.300 | 0.180 | 0.750 |
| 75/04/13 | 13 20 | | 6.900 | 0.850 | 0.185 | 0.090 | 0.270 |
| 75/04/20 | 13 50 | | 6.300 | 1.050 | 0.080 | 0.090 | 0.220 |
| 75/05/04 | 15 20 | | 6.900 | 1.050 | 0.220 | 0.040 | 0.260 |
| 75/05/17 | 19 15 | | 7.200 | 1.500 | 0.050 | 0.080 | 0.350 |
| 75/05/31 | 12 25 | | 6.800 | 2.400 | 0.300 | 0.270 | 0.660 |
| 75/06/15 | 10 45 | | 7.200 | 1.450 | 0.145 | 0.230 | 0.520 |
| 75/06/28 | 10 30 | | 9.500 | 2.350 | 0.185 | 0.135 | 0.600 |
| 75/07/13 | 09 10 | | 8.800 | 0.950 | 0.080 | 0.170 | 0.340 |
| 75/07/18 | 10 25 | | 8.000 | 1.300 | 0.100 | 0.160 | 0.350 |

STORET RETRIEVAL DATE 76/01/27

1910E1
41 30 05.0 093 15 01.0
WALNUT CREEK
19 MARION CO HWY MP
T/RED ROCK RESERVOIR
2NDRY RD BRDG 7.0 MI SSW OF PRAIRIE CITY
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/08/18 | 11 30 | | 5.100 | 1.600 | 0.080 | 0.050 | 0.410 |
| 74/09/14 | 12 10 | | 4.300 | 5.000 | 0.575 | 0.085 | 0.945 |
| 74/10/06 | 09 15 | | 0.256 | 1.400 | 0.110 | 0.045 | 0.190 |
| 74/11/02 | 10 15 | | 8.380 | 2.100 | 0.255 | 0.190 | 0.500 |
| 74/12/14 | 13 40 | | 4.000 | 0.500 | 0.115 | 0.010 | 0.015 |
| 75/01/11 | 13 30 | | 3.200 | 4.000 | 0.800 | 0.160 | 0.660 |
| 75/04/13 | 13 50 | | 6.300 | 0.650 | 0.160 | 0.035 | 0.130 |
| 75/04/20 | 11 30 | | 6.300 | 0.850 | 0.050 | 0.030 | 0.090 |
| 75/05/04 | 14 50 | | 7.000 | 0.750 | 0.470 | 0.055 | 0.130 |
| 75/05/17 | 18 50 | | 7.100 | 1.100 | 0.020 | 0.005 | 0.170 |
| 75/05/31 | 12 00 | | 6.600 | 1.650 | 0.140 | 0.065 | 0.250 |
| 75/06/13 | 11 10 | | 6.600 | 1.250 | 0.050 | 0.070 | 0.280 |
| 75/07/13 | 09 35 | | 7.800 | 1.280 | 0.080 | 0.060 | 0.195 |
| 75/07/18 | 10 45 | | 7.000 | 1.300 | 0.055 | 0.065 | 0.230 |

STORET RETRIEVAL DATE 76/01/27

1910F1
41 18 53.0 093 12 49.0
HAWK RUN
19 7.5 KNOXVILLE SW
T/RED ROCK RESERVOIR
SEC RD BRDG 1.2 M S JCT WITH HWYS 60/92
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/08/18 | 13 42 | | 0.637 | 1.150 | 0.110 | 0.065 | 0.175 |
| 74/09/14 | 14 30 | | 1.480 | 2.600 | 0.240 | 0.108 | 0.475 |
| 74/10/05 | 13 30 | | 0.352 | 2.400 | 0.470 | 0.050 | 0.250 |
| 74/11/02 | 13 20 | | 2.520 | 1.000 | 0.085 | 0.130 | 0.220 |
| 74/12/14 | 13 30 | | 2.320 | 0.500 | 0.050 | 0.035 | 0.080 |
| 75/01/11 | 12 40 | | 3.360 | 1.500 | 0.272 | 0.135 | 0.375 |
| 75/04/13 | 12 15 | | 5.500 | 0.650 | 0.045 | 0.035 | 0.080 |
| 75/04/20 | 14 55 | | 4.200 | 0.550 | 0.025 | 0.030 | 0.070 |
| 75/05/04 | 13 00 | | 4.100 | 0.850 | 0.125 | 0.070 | 0.080 |
| 75/05/20 | 10 25 | | 3.600 | 1.300 | 0.110 | 0.065 | 0.160 |
| 75/06/01 | 20 40 | | 3.200 | 1.250 | 0.040 | 0.035 | 0.120 |
| 75/06/15 | 15 30 | | 5.600 | 0.650 | 0.030 | 0.050 | 0.100 |
| 75/06/28 | 14 20 | | 4.400 | 1.250 | 0.050 | 0.070 | 0.140 |
| 75/07/13 | 12 15 | | 0.880 | 0.900 | 0.045 | 0.015 | 0.100 |

STORET RETRIEVAL DATE 76/01/27

1910G1
41 28 48.0 093 11 43.0
PRAIRE CREEK
19 7.5 KNOXVILLE NW
T/RED ROCK RESERVOIR
COUNTY TRUNK S6G BRIDGE
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/08/18 | 10 57 | | 5.100 | 1.000 | 0.105 | 0.060 | 0.140 |
| 74/09/14 | 12 24 | | 1.200 | 2.600 | 0.510 | 0.085 | 0.480 |
| 74/10/05 | 13 05 | | 0.144 | 1.400 | 0.160 | 0.030 | 0.230 |
| 74/11/03 | 10 05 | | 1.600 | 8.540 | 2.200 | 0.220 | 2.600 |
| 74/12/14 | 13 15 | | 1.360 | 1.300 | 0.290 | 0.035 | 0.220 |
| 75/04/13 | 13 35 | | 6.600 | 0.850 | 0.110 | 0.050 | 0.120 |
| 75/04/20 | 14 10 | | 6.000 | 0.700 | 0.040 | 0.045 | 0.080 |
| 75/05/04 | 15 05 | | 6.500 | 0.650 | 0.175 | 0.040 | 0.050 |
| 75/05/17 | 19 05 | | 6.300 | 1.250 | 0.135 | 0.030 | 0.120 |
| 75/05/31 | 12 15 | | 4.900 | 2.300 | 0.630 | 0.180 | 0.380 |
| 75/06/13 | 11 00 | | 5.600 | 1.150 | 0.120 | 0.095 | 0.190 |
| 75/06/28 | 10 15 | | 9.100 | 2.200 | 0.090 | 0.080 | 0.580 |
| 75/07/13 | 09 20 | | 8.400 | 1.850 | 0.095 | 0.055 | 0.130 |
| 75/07/18 | 10 35 | | 7.000 | 0.850 | 0.040 | 0.060 | 0.150 |

STORET RETRIEVAL DATE 76/01/27

1910H1
41 27 20.0 093 26 35.0
BUTCHER CREEK
19 7.5 HARTFORD
T/RED ROCK RESERVOIR
SEC RD XING 2 MI NW OF PALMYRA
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/08/18 | 15 00 | | 1.260 | 1.200 | 0.095 | 0.050 | 0.185 |
| 74/09/14 | 16 00 | | 1.320 | 3.700 | 0.185 | 0.075 | 0.460 |
| 74/10/05 | 14 15 | | 0.008 | 0.800 | 0.030 | 0.050 | 0.145 |
| 74/11/02 | 14 45 | | 1.680 | 1.500 | 0.170 | 0.200 | 0.252 |
| 74/12/14 | 15 00 | | 1.440 | 0.700 | 0.180 | 0.020 | 0.040 |
| 75/01/11 | 13 20 | | 2.240 | 2.200 | 0.384 | 0.110 | 0.400 |
| 75/04/13 | 13 05 | | 3.600 | 0.675 | 0.100 | 0.025 | 0.080 |
| 75/04/20 | 15 40 | | 2.630 | 0.550 | 0.035 | 0.025 | 0.060 |
| 75/05/03 | 13 14 | | 3.200 | 0.950 | 0.060 | 0.035 | 0.050 |
| 75/05/20 | 17 20 | | 2.200 | 1.450 | 0.115 | 0.050 | 0.210 |
| 75/06/01 | 20 00 | | 2.200 | 1.750 | 0.050 | 0.055 | 0.270 |
| 75/06/15 | 16 30 | | 4.000 | 1.050 | 0.035 | 0.056 | 0.170 |
| 75/06/28 | 14 55 | | 3.900 | 1.150 | 0.050 | 0.055 | 0.190 |
| 75/07/13 | 13 00 | | 2.800 | 0.600 | 0.025 | 0.035 | 0.080 |

STORET RETRIEVAL DATE 76/01/27

1910AA TF1910AA P300000*
41 48 40.0 091 39 15.0
DES MOINES
19007 7.5 DES MOINE SE
T/RED ROCK RESERVOIR
DES MOINES RIVER
11EPALES 2141204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P | 50051 FLOW RATE INST MGD | 50053 CONDUIT FLOW-MGD MONTHLY |
|---|---|---|---|---|---|---|---|---|---|
| 74/09/29 | 00 00 | | | | | | | | |
| CP(T)- | | | 8.700 | 15.000 | 6.300 | 7.400 | 9.400 | 27.700 | 38.500 |
| 74/09/29 | 24 00 | | | | | | | | |
| 74/10/30 | 00 00 | | | | | | | | |
| CP(T)- | | | 8.500 | 17.000 | 5.800 | 7.100 | 7.750 | 32.600 | 30.300 |
| 74/10/30 | 24 00 | | | | | | | | |
| 74/11/26 | 00 00 | | | | | | | | |
| CP(T)- | | | 11.200 | 18.000 | 6.000 | 7.800 | 10.000 | 35.900 | 35.000 |
| 74/11/26 | 24 00 | | | | | | | | |
| 74/12/29 | 00 00 | | | | | | | | |
| CP(T)- | | | 11.600 | 7.200 | 0.084 | 8.300 | 10.000 | 30.300 | 34.000 |
| 74/12/29 | 24 00 | | | | | | | | |
| 75/01/29 | 00 00 | | | | | | | | |
| CP(T)- | | | 10.100 | 16.000 | 2.640 | 6.000 | 8.200 | 35.100 | 35.400 |
| 75/01/29 | 24 00 | | | | | | | | |
| 75/02/28 | 00 00 | | | | | | | | |
| CP(T)- | | | 6.900 | 18.500 | 4.000 | 6.900 | 8.000 | 39.600 | 40.100 |
| 75/02/28 | 24 00 | | | | | | | | |
| 75/04/03 | | | 7.100 | 1.900 | 0.220 | 4.480 | 5.600 | 43.500 | 38.900 |
| 75/04/27 | 00 00 | | | | | | | | |
| CP(T)- | | | 9.800 | 7.100 | 0.480 | 4.400 | 6.300 | 39.900 | 43.200 |
| 75/04/27 | 24 00 | | | | | | | | |
| 75/05/28 | 00 00 | | | | | | | | |
| CP(T)- | | | 11.000 | 13.000 | 0.140 | 6.000 | 7.000 | 42.400 | 44.600 |
| 75/05/28 | 24 00 | | | | | | | | |
| 75/07/27 | 00 00 | | | | | | | | |
| CP(T)- | | | 11.000 | 5.800 | 0.470 | 6.800 | 7.700 | 36.900 | 39.800 |
| 75/07/27 | 24 00 | | | | | | | | |
| 75/08/25 | 00 00 | | | | | | | | |
| CP(T)- | | | 9.300 | 8.200 | 1.050 | 6.000 | 6.600 | 42.900 | 41.800 |
| 75/08/25 | 24 00 | | | | | | | | |